NOTES ON NORTH AMERICAN TREES. III. TILIA. II

C. S. SARGENT

8. TILIA NEGLECTA Spach, Ann. Sci. Nat. II. **2**:140, *t. 15*. 1834; Hist. Vég. **4**:29. 1835.—*Tilia americana* Curtis, Rep. Geol. Surv. N. Car. **3**:79 (not Linnaeus). 1860; *Tilia pubescens* Watson and Coulter, Gray's Man. ed. 6, 71 (in so far as relates to Long Island) (not Aiton). 1889; Sargent, Silva N. Am. **1**:55 (in so far as relates to Long Island). 1891; Robinson, Gray Syn. Fl. **1**[1]:343 (in so far as relates to Long Island). 1897; Britton and Brown, Ill. Fl. **2**:414 (in so far as relates to Long Island). 1897; *Tilia Michauxii* Sargent, Man. 673. *fig. 549* (not Nuttall). 1903; Robinson and Fernald, Gray's Man. ed. 7. 565. 1908; Britton and Brown, Ill. Fl. ed. 2, 513 (probably in part). 1913.—Leaves thick and firm, acute or abruptly narrowed and long-pointed at apex, obliquely concave or unsymmetrically cordate at base, coarsely serrate with straight apiculate teeth pointing forward, dark green, smooth, glabrous and lustrous above, covered below except on the midribs and veins more or less thickly with short gray pubescence often slightly tinged with brown, and furnished with conspicuous tufts of axillary hairs, usually 11–14 cm. long and 6–11 cm. wide; petioles stout, glabrous, 3–6 cm. in length. Flowers about 1 cm. long, on pubescent or nearly glabrous pedicels, in long-branched, slender, glabrous, mostly 5–15-flowered corymbs; peduncles slender, glabrous, the free portion 3–4 cm. in length, the bract nearly sessile or raised on a stalk up to 1.5 cm. in length, gradually narrowed and cuneate or unsymmetrically cuneate or rounded at base, rounded at apex, glabrous, 1–2 cm. wide and 7–15 cm. long, longer than the peduncle; sepals broadly ovate, acute, ciliate on the margins, glabrous on the outer surface, covered on the inner surface with long white hairs, about half as long as the lanceolate petals, rounded and notched at apex and rather longer than the spathulate staminodia; stamens included; style villose toward the base. Fruit ellipsoidal, ovoid, obovoid, or depressed-globose; rounded or acute or rarely gradually narrowed

and acuminate at apex, rarely 5-angled, covered with rusty or pale pubescence, usually 8–10 cm. in diameter.

A tree 25–30 m. high, with a trunk sometimes 1 m. in diameter, smooth, often pendulous, branches forming a broad round head, and slender glabrous branchlets. Winter-buds ovoid, rounded at narrowed apex, about 5 mm. long, with glabrous, red-brown or light brown scales. Bark of the trunk about 2.5 cm. thick, deeply furrowed, pale reddish brown and covered with small thin scales. Flowers at the north in July and southward about a month earlier. Fruit ripens in September.

Rich moist soil, Province of Quebec, near Montreal, to the coast of Massachusetts and New York, through the middle states to the valley of the Potomac River and along the Appalachian Mountains to those of North Carolina, and to Iuka, Tishimingo County, Mississippi, and from central and western New York to northern and southwestern Missouri (*B. F. Bush*, Noel, May 27 and October 8, 1909, nos. 5765, 5983; *E. J. Palmer*, Elk Springs, McDonald County, no. 4285; limestone cliffs, Current River, Van Buren County, July 4, 1914, no. 6180).

Although I have not seen a type specimen of SPACH's *T. neglecta*, his description can only refer to this tree, which seems to have been understood only by SPACH, whose description was made from trees cultivated in France. The younger MICHAUX must have seen it in western New York, where he found what he called *T. americana* between Batavia and New Amsterdam forming two-thirds of the forest growth. In western New York, however, *T. neglecta* is a much more common tree than *T. glabra*. GRAY, too, must have been familiar with *T. neglecta*, for it is common in central New York where as a young man he did most of his field work, and in his descriptions of *T. americana* he always says "essentially glabrous," which would indicate that it might not be always glabrous. It was mistaken for *T. glabra* by CURTIS as it seems to replace that species south of Maryland. Specimens of a tree of *T. neglecta* growing near Wading River, Long Island, have been referred by many authors to *T. pubescens* Aiton, and other authors have followed me in considering the tree which I now consider *T. neglecta* to have been the *T. Michauxii* of NUTTALL, which is the *T. argentea* of MICHAUX.

In the shape and serration of the leaves and in the size and structure of the flowers and fruit there is little by which *T. neglecta* can be distinguished from *T. glabra*, but as the absence or presence of pubescence or tomentum on American species of *Tilia* is so important in distinguishing species, and as the pubescence on the lower surface of the leaves of *T. neglecta* is so constant and so persistent throughout the season, it seems best to consider it a species rather than a pubescent form of *T. glabra*. The base of the style of *T. neglecta* is furnished with long hairs and that of *T. glabra* appears to be quite glabrous. I find a slight pubescence on a branchlet from the upper part of a tree collected by CURTIS and COIT near Ithaca, New York. SPACH describes the fruit of

his species as subpentagynous, and his figure represents a fruit with 5 distinct ridges. I have not seen such fruits on any specimens of wild trees, but they occur on two specimens of cultivated trees in the herbarium of the Arboretum, one from Germany and the other from Rochester, New York. On a tree cultivated in Goldsboro, North Carolina, the fruit is ellipsoidal and borne in unusually long-branched clusters.

9. TILIA CAROLINIANA Miller, Dict. ed. 8. 1758.—*Tilia pubescens* Aiton, Hort. Kew. **2**:229. 1789; Ventenat, An. Hist. Nat. **2**:68. 1800; Mém. Acad. Sci. Paris **4**:10. *t.* 3. 1802; Elliott, Sk. **2**:3. 1824; *Tilia multiflora*, Hort. ex Ventenat in An. Hist. Nat. **2**:64. 1800; *Tilia pubescens* var. *leptophylla* Ventenat, *l. c.*; *Tilia leptophylla* Small, Fl. Southern States 762 (in part?). 1911.—Leaves ovate, oblique and truncate or cordate at base, abruptly long-pointed at apex, coarsely dentate with broad apiculate glandular teeth pointing forward, and coated below with a rusty or pale easily detached pubescence of fascicled hairs; when they unfold coated with hoary tomentum, soon glabrous on the upper surface, and at maturity dark yellow-green and lustrous above, 7–15 cm. long and 6–12 cm. wide; petioles stout, glabrous, 2.5–4 cm. in length. Flowers 6–7 mm. long, on slender pubescent pedicels, in small stout-branched, pubescent, mostly 8–15-flowered corymbs; peduncle slender, pubescent, the free portion 2–3 cm. long, the bract nearly sessile, oblong-obovate, cuneate at base, rounded or acute at apex, when it first appears nearly glabrous on the upper surface, pubescent becoming glabrous or almost glabrous below, 2 cm. wide, longer or shorter than the peduncle; sepals ovate, acuminate, ciliate on the margins, brown and covered with pale pubescence on the outer surface, coated on the inner surface with long white hairs; petals lanceolate, acuminate, a third longer than the sepals; staminodia oblong-obovate, rounded at apex, rather shorter than the petals; style tomentose at base or glabrous. Fruit subglobose, ellipsoidal or obovoid, 7–9 mm. in diameter.

A large tree with slender, red-brown, glabrous or slightly pubescent branchlets. Winter-buds ovate, acute, glabrous or rarely pubescent, 5–6 mm. long.

NORTH CAROLINA.—Wrightsville Beach, New Hanover County, *W. W. Ashe* (no. 261); Wilmington, New Hanover County, *T. G. Harbison*, June 21, 1915, May 2, 1916 (nos. 6, 8, 11, 12).

SOUTH CAROLINA.—Near Charleston and on James Island, *T. G. Harbison*, June 17 and 18 and September 6, 1915 (nos. 1, 7, 8, 13, 14, 1*a*), September 4 and 5, 1916 (nos. 15, 17, 18), May 1, 1917, June 3, 1918 (nos. 45, 46, 47, 48); Calhoun Falls, Abbeville County, May 26, 1918 (no. 17).

GEORGIA.—Colonel's Island, near Dunham, Liberty County, *T. G. Harbison*, September 8 and 9, 1916 (nos. 3, 7), June 19, 1917 (no. 18), *Miss Julia King*, October 1917.

LOUISIANA.—Avery Island, Iberia Parish, *R. S. Cocks*, October 18, 1910 (no. 6), May 24, 1914, May 29, July 28, 1916 (nos. 4040, 4054), *Miss McIlhenny*, June 1915; Welsh, Jeff Davis Parish, *E. J. Palmer*, May 17, September 10, 1915 (nos. 7675, 8494); Opelousas, St. Landry Parish, *C. S. Sargent*, March 25, 1917; Little Bayou Têche, east of Opelousas, *R. S. Cocks*, April 3, July 24, 1916 (nos. 4012, 4016, 4018); rich woods near Winnfield, *C. S. Sargent*, April 6, 1913; Lake Charles, Calcasieu Parish, *C. S. Sargent*, April 10–13, 1915, *R. S. Cocks*, May 21, June 1, 1915 (no. 2530); Natchitoches Parish, Natchitoches, *R. S. Cocks*, April 15 and 27, 1911, *E. J. Palmer*, April 17 and 23, May 3, June 10 and 14, July 10, September 30, 1915 (nos. 7397, 7474, 7946, 7952, 8013, 8021, 8747, 9416); Creston, *E. J. Palmer*, April 28, 1915 (no. 7420); Chopin, May 6, 1915 (no. 7554).

ARKANSAS.—Fulton, Hempstead County, *B. F. Bush*, October 4, 1909 (no. 5926); Gum Springs, Clark County, *E. J. Palmer*, June 20, 1915 (no. 8074).

TEXAS.—Palestine, Anderson County, *E. J. Palmer*, September 21, 1917 (no. 12816); Marshall, Harrison County, June 8 and September 26, 1915 (nos. 7910, 8673), March 29, 1918 (no. 1320); Groesbeck, Limestone County, June 1, 1915 (no. 7934); Jacksonville, Cherokee County, June 4, 1915 (no. 7871); Larissa, Cherokee County, April 7, 1916 (nos. 9374, 9381); Houston, Harris County, September 15, 1917 (no. 12759); San Augustine, San Augustine County, April 19 and September 8, 1916 (nos. 9498, 10637); near Pledger, Matagorda County, May 8, 1916 (nos. 9698, 9704); Dayton, Liberty County, May 25, 1915 (no. 7767); Blanco, Blanco County, June 4, 1917 (no. 12165); near Boerne, Kendall County, *S. H. Hastings*, 1911, *C. A. Schattenberg*, 1915, *C. S. Sargent*, 1915, *E. J. Palmer*, September 29, 1916 (no. 10866), April 20, 1917 (no. 10866).

MEXICO.—Botteri, "998 Juni 55, Orizaba" (in Herb. Kew), Orizaba, 63, 1869 (in Herb. Kew), Pr. el Chica, *C. Erenberg* (in Herb. Kew, with slightly pubescent branchlets and winter-buds).

MILLER'S specimen of his *T. caroliniana* from a tree cultivated in England, where it had been introduced from Carolina by CATESBY, is preserved in the British Museum, the name being written on the sheet in MILLER'S handwriting. This specimen is also the type of AITON'S *T. pubescens*, that name also appearing on the sheet in AITON'S or DRYANDER'S handwriting. This specimen has glabrous branchlets, coarsely serrate leaves, very oblique and truncate at base, and covered below, like the corymbs, with rusty pubescence. The leaves are rather smaller than those of the trees now growing about Charleston Harbor,

as might be expected in the case of a tree from the southern states cultivated in England. There is no other linden in the South Carolina region which at all agrees with MILLER'S specimen, and his name can properly be taken up for this tree. *T. caroliniana* has usually been considered a synonym of *T. americana* Linnaeus, and *T. pubescens* has been adopted for one of the southern coast species. This name, however, except as a synonym of *T. caroliniana*, must now disappear.

The leaves of the specimens collected west of the Mississippi River which are here referred to *T. caroliniana* are certainly not thinner than those from the Carolina coast region, and I can find no characters by which the eastern and western trees can be distinguished. As here understood the range of *T. caroliniana* is remarkable, as there is no evidence that it occurs between the coast of Georgia and western Louisiana.

TILIA CAROLINIANA var. **rhoophila,** n. var.—*Tilia pubescens* Torrey and Gray, Fl. N. Am. 1:240 (insomuch as relates to Texas). 1842; *Tilia pubescens* Sargent, Silva N. Am. 1:55 (insomuch as relates to Louisiana and Texas). 1891, and later authors; *Tilia pubescens* var. a *Aitonii*, V. Engler, Monog. Tilia, 128 (insomuch as relates to Texas specimens). 1909.—Differing from the type in its pubescent branchlets and winter-buds, its usually larger leaves, and in its tomentose corymbs of more numerous flowers. Leaves broadly ovate, oblique and truncate or cordate at base, abruptly short-pointed and acuminate at apex, coarsely serrate with broad apiculate teeth pointing forward, dark green and lustrous on the upper surface, pale and thickly covered on the lower surface with persistent white or brownish pubescence, 10–12 cm. long and 7–12 cm. wide, with slender midribs and primary veins pubescent on the lower side and small conspicuous axillary tufts of pale hairs; petioles stout, thickly coated with pubescence, 2.5–4 cm. in length; on vigorous shoots leaves often 16 cm. long and 14 cm. wide, and occasionally 24 cm. long and 18 cm. wide. Flowers 5–6 mm. long, on short, hoary tomentose pedicels in wide, thin-branched, pubescent, many-flowered (sometimes 50) corymbs; peduncle thickly covered with fascicled hairs, the free portion 3.5–5 cm. long, the bract oblong, unequally rounded at base, rounded at apex, glabrous on the upper, pubescent on the lower surface, 1.5–2 cm. wide, usually shorter than the peduncle; sepals acuminate, coated on the outer surface with pale or slightly rusty pubescence, villose and furnished at base on the inner surface with tufts of long hairs; petals lan-

ceolate, acuminate and ciliate at apex, about a third longer than the sepals; staminodia spatulate, acute, about half the length of the petals; style coated at base with long white hairs. Fruit subglobose, covered with rusty tomentum, 7–8 mm. in diameter.

A tree with slender branchlets thickly coated during their first year with pale pubescence, dark red-brown or gray and puberulous during their second season. Winter-buds covered with pale pubescence.

ARKANSAS.—Fulton, Hempstead County, *E. J. Palmer*, June 17, 1915 (no. 8023); Gum Springs, Clark County, June 21, 1915 (no. 8074).

LOUISIANA.—Bank of the Calcasieu River, Lake Charles, Calcasieu Parish, *R. S. Cocks*, May 21, 1916 (no. 2532), *C. S. Sargent*, March 23, 1917; low woods, Welsh, Jeff Davis Parish, *E. J. Palmer*, May 17, June 21, and September 10, 1915 (nos. 7674, 8074, 8500).

TEXAS.—Houston, Harris County, *F. Lindheimer*, 1842 (no. 10830 in Herb. Missouri Bot. Gard.), *E. J. Palmer*, May 24 and 26 and September 17, 1915 (nos. 7758, 7776 type for flowers, 8578), April 29, 1916 (no. 9613), April 2, May 16, 17, 18 and September 15, 18, 1917 (nos. 11142, 11443, 11448, 11451, 11454, 11911, 11912, 11913, 11914, 11916, 11917, 11918, 11933, 11934, 11946, 11964, 12755, 12756, 12758, 12762, 12788), March 19, 29, 1918 (nos. 13114, 13115); Harrisburg, Harris County, *E. J. Palmer*, May 17, 1917 (no. 11933); Morgan's Point, Harris County, *E. J. Palmer*, May 20, 1917 (no. 11957); near Pledger, Matagorda County, *E. J. Palmer*, May 8, 1916 (no. 9695); Dayton, Liberty County, *E. J. Palmer*, May 25 and September 16, 1915 (nos. 7672, 7767, 7770, 8548, 8564, 8566), April 28, 1916 (nos. 9603, 9604, 9605, 9607), April 3, May 21, and September 17, 1917 (nos. 11457, 11458, 11460, 11465, 11466, 11975, 11976, 11982, 11984, 12776, 12777, 12778, 12779 with bracts of the peduncles 10–11 cm. long and 3.5 cm. wide); Palestine, Anderson County, *E. J. Palmer*, May 29, 1917 (no. 12086); Marshall, Harrison County, *B. F. Bush*, August 9, 1901 (no. 659), *E. J. Palmer*, June 8, 1915 (no. 7922); College Station, Brazos County, *E. J. Palmer*, April 28, 1917 (nos. 11720, 11721); Bryan, Brazos County, *E. J. Palmer*, April 28, 1917 (no. 11721); Liberty, Liberty County, *E. J. Palmer*, May 22, 1915 (no. 7735), April 28, 1916 (no. 9594); Livingston, Polk County, September 12, 1916 (no. 10697), September 19, 1917 (no. 12798); New Braunfels, Comal County, *F. Lindheimer*, 1842 (no. 10839 in Herb. Missouri, Bot. Gard.); rocky banks of the Guadalupe River, Kerrville, Kerr County, *E. J. Palmer*, April 29, 1916 (nos. 9931, 9934).

Growing usually on the margins of sandy bogs and on moist sandy hillsides, this tree varies, according to the moisture it obtains, in the size of the leaves and in the amount of the pubescence on the branchlets. The bark on trees growing in wet situations is smooth and pale, but on trees in dry soil or higher on the hillsides it is dark and rough; the leaves are smaller and the branchlets are less pubescent.

10. **Tilia texana**, n. sp.—*Tilia pubescens* var. *β Ventenatii* V. Engler Monog. Tilia 129 (in part). 1909.—Leaves thin, oblong-ovate, abruptly contracted into long slender acuminate points, cordate or obliquely cordate at base, finely dentate with broad apiculate teeth; early in the season pubescent above with scattered fascicled hairs and covered below with brownish, slightly attached pubescence, and in the autumn light yellow-green, lustrous and nearly glabrous on the upper surface, slightly pubescent on the lower surface, 10–14 cm. long and 8–10 cm. wide, with slender midribs and primary veins sparingly villose on the upper side and nearly glabrous on the lower side, and small axillary tufts of brownish hairs; petioles slender, pubescent with fascicled hairs, 2.5–4 cm. in length; leaves on vigorous shoots often furnished with one or two large, lateral, acuminate, serrate lobes, more coarsely dentate and more thickly covered on the lower surface with pubescence, often 13–15 cm. long and 9–15 cm. wide. Flowers 6–7 mm. long on slender tomentose pedicels in small, villose-pubescent, mostly 7–10-flowered corymbs; peduncle slender, slightly villose-pubescent, the free portion 3–3.5 cm. in length, the bract oblong-ovate to slightly obovate, unsymmetrically cuneate at base, rounded and occasionally lobed at apex, glabrous on the upper surface, densely pubescent early in the season, later becoming nearly glabrous on the lower surface, longer or shorter than the peduncle; sepals ovate, acute, pale pubescent on the outer surface, covered on the inner surface with white hairs longer and more abundant near the base; petals lanceolate, acuminate, a third longer than the sepals; staminodia linear-lanceolate, acuminate; style hoary tomentose at the base. Fruit ellipsoidal, covered with rusty brown tomentum, 8–9 mm. long and 5–6 mm. in diameter.

A small tree with slender branchlets thickly covered during their first season with close pale pubescence, and pale and puberulous or glabrous in their second year. Winter-buds ovate, obtusely pointed, thickly covered with pale pubescence, 4–5 mm. long. On vigorous terminal branchlets the pubescence is thicker and light rusty brown.

TEXAS.—Columbia, Brazos County, *B. F. Bush*, October 18, 1900 (no. 1570), September 25, 1901 (no. 914); Houston, Harris County, *E. J. Palmer*, September 17, 1915 (no. 8578), April 29, 1916 (nos. 9608, 9610); Larissa, Cherokee County, June 3 and September 22, 1915 (nos. 7845, 8620); on Spring Creek,

near Boerne, Kendall County, *E. J. Palmer*, April 7 and September 29, 1917 (nos. 11485, 12899); along the southwest bank of the Guadalupe River on the rocky talus in a canyon at the foot of a limestone bluff at Kerrville, Kerr County, *E. J. Palmer*, October 2, 1916 (nos. 10887, 10888 type for fruit), April 8 and June 9, 1917 (nos. 11495, 11501, 11502, 12212, 12213 type for flowers, 12214).

I have not seen leaves and pedunculate bracts with lateral lobes on any other American linden.

TILIA TEXANA var. **grosseserrata,** n. var.—Differing from the type in the coarse serration of the leaves, in the absence of lateral lobes on the leaves and on the bracts of the peduncles, and in the constantly pale, never rusty pubescence of the branchlets and winter-buds.

A small tree with several stems 7–9 m. high, the bark dark gray and rough near the ground and smooth and pale above, in rocky soil at the foot of a limestone bluff by a small stream forming the head of the Sabinal River, near Utopia, Uvalde County, Texas, *E. J. Palmer*, June 17, 1916 (no. 10227 type), April 10 and October 6, 1917 (nos. 11522, 12937).

At the end of their first winter the branchlets of this tree are pale pubescent, puberulous or nearly glabrous, and the winter-buds are reddish or pale brown and glabrous. This linden is interesting as the most western representative of the genus in the United States.

11. **Tilia phanera,** n. sp.—Leaves semiorbicular to broadly ovate, deeply and usually symmetrically cordate at base, abruptly short-pointed at apex, finely dentate with straight or incurved apiculate teeth; when they unfold glabrous above with the exception of a few hairs on the midribs and veins, and thickly coated below with hoary tomentum, and at maturity thin, blue-green, smooth and lustrous on the upper surface, paler and often brownish and coated with a floccose easily detached pubescence of fascicled hairs on the lower surface, 5–9 cm. wide and usually rather broader than long, with slender midribs and primary veins pubescent on the lower surface, and small axillary clusters of rusty brown hairs; petioles slender, coated when they first appear with hoary tomentum, glabrous or slightly pubescent in the autumn, 2.5–4 cm. in length. Flowers 5–6 mm. long, on tomentose pedicels in compact, villose, mostly 16–20-flowered corymbs; peduncle villose, the free portion 1.2–1.5 cm. in length, the bract longer than the peduncle,

short-stalked, obovate, cuneate at base, broad and rounded at apex, floccose pubescent on the lower surface, nearly glabrous on the upper surface; sepals acuminate, pale pubescent on the outer surface, villose along the margins and furnished at the base on the inner surface with a tuft of long white hairs, broader and shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, style glabrous except at the base. Fruit ellipsoidal, covered with rusty tomentum, 8–10 mm. long and 6–7 mm. wide, on stout, densely floccose-pubescent pedicels.

A tree with slender, light gray-brown, often zigzag branchlets covered when they first appear with fascicled hairs, deciduous during their first summer. Winter-buds ovate, obtusely pointed, terete, reddish brown, glabrous, 4–5 mm. long. Flowers the middle of June. Fruit ripens the end of September.

Banks of Spring Creek, near Boerne, Kendall County, Texas, *E. J. Palmer*, September 27, 1916 (no. 10825 type); April 7 and 11 and June 13, 1917 (nos. 11486, 11593, 12242).

TILIA PHANERA var. **scabrida,** n. var.—*Tilia pubescens* var. a *Aitonii* f. *gymnophylla* V. Engler, Monog. Tilia 130 (in part). 1909. —Differing from the type in the scabrate lower surface of the leaves. Leaves broadly ovate, cordate at base, abruptly short-pointed at apex; when they unfold pubescent above with scattered straight white hairs and hoary tomentose below, and at maturity thin, yellow-green and glabrous above and roughened below by the persistent bases of fascicled hairs, 10 cm. long and broad; petioles 2–2.5 cm. in length. Flowers not collected. Fruit on tomentose pedicels, ovoid to subglobose, covered with pale reddish tomentum.

A small tree with dark deeply ridged bark and glabrous branchlets.

On a low limestone bluff of the Blanco River, near Blanco, Blanco County, Texas, *J. Reverchon*, July 1885 (no. 1500 type), *E. J. Palmer*, April 16 and September 24, 1917 (nos. 11565, 12858); College Station, Brazos County, Texas, *B. F. Bush*, July 4, 1900 (nos. 1915, 4345); Velasco, Brazoria County, Texas, *E. J. Palmer*, March 21, 1918 (no. 13139).

12. **Tilia lasioclada,** n. sp.—Leaves ovate, abruptly contracted at apex into short acuminate points, oblique and truncate or on weak branchlets, often nearly symmetrical and deeply cordate at base, and finely serrate with straight apiculate teeth; when they unfold covered above with soft caducous hairs, pubescent below, and at

maturity thick, bright green, smooth and lustrous on the upper surface, pale and covered on the lower surface with a thick floccose, easily detached pubescence of fascicled hairs, pale on those of lower leaves and often rufous on those of upper branches, 10–15 cm. long and 8–12 cm. wide, the slender midribs and veins covered below with straight hairs mixed with fascicled hairs, and small conspicuous axillary tufts; petioles covered when they first appear with straight hairs mixed with fascicled hairs, soon glabrous, usually 3–4 cm. in length, those of the leaves of weak branchlets very slender and often 5–6 cm. long. Flowers 5–6 mm. long, on stout villose pedicels, in long-branched, mostly 10–15-flowered corymbs more or less thickly covered with straight white hairs; peduncle covered with long white hairs, the free portion 2.5–3 cm. in length, the bract nearly sessile, rounded and unsymmetrical or acute at base, rounded or acute at apex, the midrib more or less thickly covered on the lower side with straight hairs, otherwise glabrous, 2–5 cm. wide; sepals narrow, acute, pubescent on the outer surface, villose on the inner surface, about one-third as long as the lanceolate acuminate petals; staminodia spathulate, rounded and often lobed at apex, about as long as the sepals; style slightly villose at base. Fruit globose or depressed-globose, covered with rusty tomentum, about 1 cm. in diameter.

A tree sometimes 20 m. high with a trunk 30–60 cm. in diameter, stout branches forming a broad round-topped head, and stout red-brown branchlets sometimes glabrous in early summer and sometimes covered more or less thickly during their first and second seasons with long straight hairs.

South Carolina.—Calhoun Falls, Abbeville County; upland woods, Anderson County, *T. G. Harbison*, May 21, 1918; rich wooded slopes near the Savannah River, three miles below Augusta, *T. G. Harbison*, June 17 and August 23, 1916 (no. 8 type), June 17, 1917 (no. 9); Beach Island, a rich wooded slope rising from the north bank of the Savannah River a few miles below Augusta, *R. C. Berckmans*, June 12, 1914.

Georgia.—Shell Bluff on Savannah River 30 miles below Augusta, Richmond County, *C. S. Sargent*, April 6, 1914; steep rocky bluff at the Locks above Augusta, *T. G. Harbison*, May 13, 1913 (nos. 1162, 1163), May 27 and October 6, 1914 (no. 9), April 6, 1916 (no. 6), August 23, 1916 (nos. 12, 13). Brickyard near the Berckman's Nursery west of Augusta, October 5, 1914 (no. 7), August 23, 1916 (no. 16), June 29, 1917 (no. 16), May 31, 1918 (no. 31), May 30, 1918 (nos. 18, 20, 21 type).

FLORIDA.—River Junction, Gadsden County, *T. G. Harbison*, April 25 and September 21, 1914 (no. 1479), April 19 and June 25, 1917 (nos. 116, 119).

From all other American lindens this species differs in the straight hairs on the lower side of the midribs and veins of the leaves, on the peduncle and branches of the inflorescence and on the branchlets, and similar to those of the European *Tilia platyphyllos* Scopoli. The number of these hairs varies on different individuals, and on some trees the branchlets become nearly glabrous by the middle of June, while on others the hairs are present for 2 or 3 years. They are longer and more abundant on the trees growing on the Savannah River at the Locks above Augusta than on trees from other localities, and do not entirely disappear until their third season.

13. TILIA HETEROPHYLLA Ventenat.—Different plants have been referred to this species and it is still by no means clear what should be taken as the type. VENTENAT gives the locality for his tree as "la basse Caroline" where it was discovered by MICHAUX and FRASER. "Basse Caroline" may mean the coast region or the whole state east of the mountains. There is no *Tilia* in the South Carolina coast region which at all agrees with VENTENAT's description and figure, but near Augusta and in Columbia County, Georgia, and in the neighborhood of Walhalla in Oconee County, South Carolina, on the eastern foothills of the Blue Ridge, a linden is common which in the shape of the leaves agrees better with those figured by VENTENAT than any I have seen. MICHAUX in his journeys from Charleston to the high Carolina mountains went up the valley of the Savannah River and passed by Augusta and through Oconee County, South Carolina. VENTENAT describes the leaves of *T. heterophylla* as snow white on the lower surface. On the Georgia and Walhalla trees the tomentum on the lower surface of some of the leaves is white and on others, especially from upper branches, it is rusty brown, a peculiarity of this tree which is common in other parts of the country. VENTENAT describes the fruit of his tree as globose and 5-ribbed. The fruit which he figured, however, is ellipsoidal and shows no trace of ribs. If the Walhalla trees, as I believe, are to be considered typical of *T. heterophylla* Ventenat, that species may be described as follows:

TILIA HETEROPHYLLA Ventenat, An. Hist. Nat. **2**:63. 1800; Mém. Inst. Paris **4**:16. *t.* 5.—Leaves ovate, obliquely truncate or rarely slightly cordate at base, gradually narrowed and acuminate

at apex, finely dentate with apiculate gland-tipped teeth; when they unfold pubescent on the upper surface with caducous fascicled hairs, and at maturity dark green and glabrous on the upper surface, covered below with thick, firmly attached, white or on upper branches often brownish tomentum, and usually furnished with small axillary tufts of rusty brown hairs, 8–13 cm. long and 6–10 cm. wide; petioles slender, glabrous, 3.5–4 cm. in length. Flowers 6–7 mm. long on pedicels pubescent with fascicled hairs, in wide mostly 10–20-flowered pubescent corymbs; peduncle glabrous, the free portion 2–4 cm. in length, the bract narrowed and rounded at apex, unsymmetrically cuneate at base, pubescent on the upper, tomentose on the lower surface when it first appears, becoming glabrous, nearly sessile or raised on a stalk up to 1 cm. in length; sepals acuminate, pale-pubescent on the outer surface, villose on the inner surface and furnished at base with a tuft of long white hairs; petals lanceolate, acuminate, a third longer than the sepals; staminodia oblong-ovate, acute, sometimes notched at apex; style villose at base with long white hairs. Fruit ellipsoidal, apiculate at apex, covered with rusty brown tomentum, 7–10 mm. long.

A large tree, with slender, glabrous, reddish or yellowish brown branchlets and oblong-ovate, slightly flattened, glabrous winter-buds 5–7 mm. in length, the outer scales slightly ciliate at apex.

NORTH CAROLINA.—Falls of the Yadkin River, Stanley County, *J. K. Small*, August 1892; near Newbern, Craven County, *T. G. Harbison*, June 5, 1918 (nos. 42, 44 with styles villose to the middle).

SOUTH CAROLINA.—Walhalla, Oconee County, *T. G. Harbison*, June 4 and 22, 1915, March and October 11, 1917; Russell, Oconee County, *T. G. Harbison*, May 5 and June 29, 1917 (nos. 3, 4), July 7, 1917 (nos. 18, 20).

GEORGIA.—Cornelia, Habersham County, *T. G. Harbison*, July 7, 1917 (nos. 18, 20); Toccoa, Stevens County, *T. G. Harbison*, June 15, 1918 (no. 9); banks of Flint River, Albany, Dougherty County, *J. K. Small*, May 24–28, 1896, *T. G. Harbison*, June 25, 1915 (no. 3); near Zluguenin, Sumter County, *R. M. Harper*, July 11, 1901 (no. 1049); banks of Savannah River, Germain's Island, Columbia County, *R. M. Harper*, June 1, 1902 (no. 1302).

FLORIDA.—Tallahassee, Leon County, *T. G. Harbison*, June and September 1915 (nos. 1–6); River Junction, Gadsden County, June 1915 and 1916 (nos. 1, 8, 14, 17, 18, 19, 20, 22, 23, 28, 30, 34, 36, 37, 38, 62); Rock Cave, Jackson County, *R. M. Harper*, April 28, 1910; near Marianna, Jackson County, *T. G. Harbison*, September 18, 1916 (nos. 2, 4), May 26, 1917 (no. 21).

ALABAMA.—Berlin, Dallas County, *R. S. Cocks*, June 4, 15, 1915 (nos. 780, 782), July 20, 26, 1916 (nos. 962, 970, 1012), June 18, July 25, 1918 (nos. 790, 792); near Selma, Dallas County, *T. G. Harbison*, April 20, 1915 (no. 22).

WEST VIRGINIA.—White Sulphur Springs, Greenbrier County, *Kenneth Mackensie*, no. 7532 in Herb. Mo. Bot. Gard. (*T. heterophylla* var. *microdonta* V. Engler, Monog. *Tilia*, 135).

INDIANA.—Near Vevay, Switzerland County, *C. C. Deam*, July 25, 1913, June 19 and September 8, 1915 (nos. 13808, 16159, 18806); near the Ohio River, Jefferson County, September 8, 1915 (no. 16219).

On the Florida trees the clusters of hairs at the base of the inner surface of the sepals and the hairs at the base of the style are sometimes wanting; and the fruit is subglobose, sometimes longer than broad or a little broader than long. Like the trees at Walhalla, the tomentum on the under surface of the leaves of the upper branches is usually rusty brown and silvery white on those of the lower branches.

This linden is the common species in the neighborhood of Tallahassee and River Junction, and it appears to have been usually confounded in recent years with a tree of the higher Appalachian Mountains to which I have given the name of *T. monticola*. In the size and shape of the leaves this mountain tree resembles those of *T. heterophylla*, but the tomentum on the lower surface is thicker and whiter and never brown; the petioles are longer and the flowers are nearly twice as large; the branches are red, not yellowish brown, and the winter-buds are larger, more compressed, and bright red.

TILIA HETEROPHYLLA, var. **Michauxii,** n. var.—*Tilia alba* Michaux f. Hist. Arb. Am. 3:315, *t. 2* (not Linnaeus). 1813; *Tilia heterophylla* Nuttall, Silva 1:90, *t. 23*. 1842, and of many authors insomuch as relates to the Northern States; *Tilia Michauxii* Nuttall, Silva 1:92. 1842; Britton and Shafer, North Am. Trees 688 (in part). 1908; Britton and Brown, Ill. Fl. ed. 2, 2:513 (in part), *fig. 2846*. 1913; *Tilia eburnea* Ashe, BOT. GAZ. 33:230. 1902; *Tilia apposita* Ashe, Bull. Charleston Mus. 13:27. 1917; *Tilia tenera* Ashe, *l.c.* 1917.—Differing from the type in the usually cordate, rarely obliquely truncate, more coarsely serrate leaves, broader and more abruptly acuminate at apex, and always white or grayish white, not brownish, tomentose below.

This is one of the most widely distributed of the American lindens, ranging from the valley of the Susquehanna River in Pennsylvania, where it was first noticed by the younger MICHAUX in Lancaster County, to southern and western New York, through southern Ohio and Indiana to northeastern Missouri (Ilasco, Ralls County, *John Davis*, September 30, 1914 (no. 3164), southwestern Missouri (Eagle Rock, Barry County, *E. J. Palmer*, July 16, 1914, no. 6287),

and northwestern Arkansas (Eureka Springs, Carroll County, *E. J. Palmer*, September 21, 1913, no. 4412, Cotter, Marion County, September 1, 1915, no. 8405). Southward it ranges through eastern Kentucky and Tennessee to northeastern Mississippi, along the Appalachian Mountains and their foothills to northern Georgia and to southern Georgia and Dallas County, Alabama. I have not seen specimens of this linden from Illinois, although it may be expected to occur in ravines near the Ohio River in the southern part of the state.

TILIA HETEROPHYLLA var. **nivea,** n. var.—Differing from the type in the whiter tomentum on the lower surface of the leaves, the glabrous styles, in the tomentum on the lower side of the bract of the peduncle at the time the flowers open, the slightly pubescent gray or pale reddish brown branches, and in the puberulous winter-buds.

FLORIDA.—In deep woods, River Junction, Gadsden County, *T. G. Harbison*, April 19 and June 25, 1917 (no. 29 type), June 7, 1915, and June 25, 1917 (no. 27), *A. H. Curtiss*, June 4 and September 13, 1897 (no. 5875).

TILIA HETEROPHYLLA var. **amphiloba,** n. var.—Differing from the type in the fascicled hairs on the upper surface of the young leaves and in the often pubescent branchlets. Leaves broadly ovate, sometimes broader than long, abruptly short-pointed or gradually narrowed and acuminate, or occasionally rounded at apex, symmetrically or obliquely cordate or obliquely truncate at base, finely serrate with apiculate teeth; when they unfold hoary tomentose below and covered above with fascicled hairs, and at maturity thin, dark yellow-green, smooth and lustrous on the upper surface, pale green or brownish and covered below with thick, white, somewhat loose tomentum, on lateral branchlets 4–6 cm. long and 5–7 cm. wide, and on leading shoots 9–10 cm. long and 7–8 cm. wide, the midrib and primary veins covered below with fascicled hairs; axillary hairs rusty brown in small inconspicuous tufts, often wanting; petioles slender, sparingly pubescent when they first appear, becoming glabrous, 2–2.5 cm. in length. Flowers 4–5 mm. long, on stout tomentose pedicels, in broad, thin-branched, slightly pubescent, 7–25-flowered corymbs; peduncle slender, pubescent, the free portion 3–5 cm. in length, the bract oblong to oblong-obovate, cuneate at base, rounded at apex, short-stalked

or nearly sessile, 7 mm.–2.5 cm. in width, thickly covered when it first appears with hoary tomentum, and at maturity tomentose on the upper and pubescent on the lower surface; sepals acuminate, densely pubescent on the outer surface, villose near the margins on the inner surface, about as long as the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, about as long as the sepals; style slightly villose at base. Fruit ellipsoidal, covered with rusty brown tomentum, 7–8 mm. long and 5–6 mm. in diameter.

A tree 20 m. high with slender red-brown or orange-brown branchlets glabrous or sometimes covered early in their first season with fascicled hairs. Winter-buds terete, glabrous or when first formed sparingly villose, 2–3 mm. in length. Flowers at the end of June and at River Junction later than the other species with which it is associated. Fruit ripens the middle of September.

FLORIDA.—In woods in sandy soil, River Junction, Gadsden County, *T. G. Harbison*, April 26 and September 21, 1914, April 19 and June 25, 1917 (no. 1484 type), September 21, 1914 (no. 1), June 7 and 28 and September 14, 1915 (nos. 12, 13, 34, 34a, 36, 36a).

ALABAMA.—Valley Head, Dekalb County, *T. G. Harbison*, June 26, 1918 (nos. 42, 42).

I once believed that these trees could be specifically separated from *T. heterophylla*, but their close connection with that species is shown by a tree of *T. heterophylla* var. *Michauxii* which was growing near Tiptop, Tazewell County, Virginia, in May 1914 (*T. G. Harbison*, no. 1616). The upper surface of the leaves of this tree were then covered with fascicled hairs and the branchlets were glabrous. When I visited Tiptop in September of the same year this tree had been cut down, but had produced shoots from the stump which were thickly covered with fascicled hairs and bore large leaves densely pubescent on the upper surface.

14. **Tilia monticola,** n. sp.—*Tilia heterophylla*, Sargent, Silva N. Am., **1**:59 (in part, not Ventenat). *t. 27.* 1891; Man. 674 (in part). *fig. 550;* Robinson in Gray Syn. Fl. **1**[1]:344 (in part). 1908; Small, Fl. S. States 761 (in part). 1903; Robinson and Fernald, Gray's Man. ed. 7, 566 (in part). 1908; Britton and Shafer, N. Am. Trees 686 (in part). 1908; Britton and Brown, Ill. Fl. ed. 2, **2**:512 (in part). 1913.—Leaves thin, ovate to oblong-ovate, very oblique and truncate or obliquely cordate at base, gradually narrowed and acuminate at apex, finely serrate with straight or incurved apiculate teeth, smooth, dark green and lustrous on the upper surface, thickly

coated on the lower surface with hoary tomentum, 10–17 cm. long and 8–12 cm. wide; petioles slender, glabrous, 4–7 cm. in length. Flowers 10–12 mm. long, on stout sparingly pubescent pedicels in mostly 7–10-flowered, thin-branched, glabrous corymbs; peduncle slender, glabrous, the free portion 3.5–4 cm. in length, the bract gradually narrowed and cuneate or rounded at base, narrowed and rounded at apex, glabrous, 10–14 cm. long and 2–2.5 cm. wide, its stalk varying in length from 1 to 2.5 mm.; sepals ovate, acute, ciliate on the margins, covered on the outer surface with short pale pubescence and with silky white hairs on the inner surface; petals lanceolate, acuminate, twice longer than the sepals; staminodia oblong-lanceolate, rounded at the narrowed apex, as long or nearly as long as the petals; style clothed at the base with long white hairs. Fruit ovate to ellipsoidal, covered with pale rusty tomentum, 7–8 mm. long and 6–7 mm. in diameter.

A tree rarely exceeding 20 m. in height with a trunk 1–1.10 m. in diameter, slender branches forming a narrow rather pyramidal head, and stout glabrous branchlets usually bright red during their first year, becoming brown in their second season. Winter-buds compressed, ovate, acute or rounded at apex, light red, covered with a glaucous bloom, 7–10 mm. long. Bark of the trunk 1.5 cm. in thickness, deeply furrowed, the surface broken into small, thin, light brown scales. Flowers from July 12 to July 25. Fruit ripens in September.

NORTH CAROLINA.—Highlands, Macon County, at an altitude of about 600 m., *T. G. Harbison* (many specimens), June, July, and September 1915; Busbee Mountain, near Biltmore, July 5 and September 16, 1897 (ex herb. Biltmore 1030 B).

TENNESSEE.—Johnson City, Washington County, *Gray*, *Sargent*, *Redfield*, and *Canby*, June 21, 1877.

VIRGINIA.—Farmer Mountain, on New River, Cornell County, *J. K. Small*, July 12, 1892, "altitude 2200 feet."

This tree has long been confounded with *T. heterophylla* and its variety *Michauxii*. From these trees it differs in its larger leaves generally more oblique at base, covered below with a denser, always silvery white, tomentum, its longer petioles, its fewer flowered corymbs and in its larger flowers which are larger than those of the other American lindens. It differs, too, in its stouter branchlets, and in the winter-buds which are red, compressed, and much larger than those of other American lindens. At Highlands, North Carolina, where this and *T. heterophylla* var. *Michauxii* are common at altitudes between 400 and 600 m., *T. monticola* flowers 10 or 12 days later than the other tree. The specimen from Johnson City, Tennessee, although it is from a much lower

altitude than the others, is typical of the species, with leaves very oblique at base and up to 17 cm. long on the flowering branches; the petioles vary from 6 to 8 cm. in length. The pedunculate bract is 1.5 cm. in length. At this low altitude the trees naturally bloom earlier than at Highlands. *T. monticola*, with its large leaves snowy white on the lower surface and drooping gracefully on their long petioles, and its large flowers, is the showiest of the American lindens.

15. **Tilia georgiana,** n. sp.—*Tilia pubescens* Ventenat, Ann. Hist. Nat. **2**:62. 1800; Mém. Acad. Sci. **4**:10. *t. 3* (not Aiton). 1802.—Leaves ovate, slightly unsymmetrical at base and usually cordate on lateral branches and often oblique or truncate on leading branches, abruptly short-pointed at apex, and finely dentate, with glandular teeth pointing forward; when they unfold deeply tinged with red, covered above by fascicled hairs and tomentose below; when the flowers open dark yellow-green, dull and scabrate above and covered below with a thick coat of tomentum, pale on those of the lower branches and tinged with brown on those from the top of the tree, conspicuously reticulate-venulose, and at maturity thick, dull yellow-green, pubescent or glabrous above, rusty or pale tomentose below, sometimes becoming nearly glabrous in the autumn, 6–10 cm. long and 5–8 cm. wide; petioles slender, tomentose, 2–4 cm. in length. Flowers 6–7 mm. long, on slender pubescent pedicels in compact, slender-branched, pubescent, mostly 10–15-flowered corymbs; peduncle slender, pubescent on the lower, nearly glabrous on the upper, surface, the free portion 2.5–3 cm. in length; sepals ovate, acuminate, coated on the outer surface with pale pubescence and on the inner surface with pale hairs longest and most abundant at the base, not more than one-half the length of the lanceolate acuminate, narrow petals; staminodia oblong-obovate to spathulate, acute, about two-thirds as long as the petals; style glabrous or furnished with a few hairs at the very base. Fruit on pubescent pedicels, depressed-globose, occasionally slightly grooved and ridged, covered with thick rusty tomentum, 5–6 mm. in diameter.

A tree with slender branchlets thickly coated during their first season with pale tomentum, and dark red-brown or brown and puberulous in their second year. Winter-buds covered with rusty brown pubescence, 6–7 mm. long. Flowers the middle of June. Fruit ripens early in September.

SOUTH CAROLINA.—Near Charleston, *T. G. Harbison*, September 4, 1916 (no. 16).

GEORGIA.—Colonel's Island, near Dunham, Liberty County, *T. G. Harbison*, September 9, 1916 (nos. 4, 5, 8, 9), June 19, 1917 (no. 19); Brunswick, Glynn County, *T. G. Harbison*, May 24, June 19, September 2 and 3, 1916 (nos. 6, 7 type, 10, 11, 13, 15).

FLORIDA.—San Mateo, Putnam County, *A. H. Curtiss* (no. 401a), Gainsville, Alachua County, *T. G. Harbison*, June 10 and September 10, 1915, June 21 and September 14 and 15, 1916, April 24 and 25 and June 15, 1917; Lake City, Columbia County, *G. V. Nash*, July 11–19, 1895, *T. G. Harbison*, June 14, 1915, September 16, 1916, April 22 and June 23, 1917; Sumner, Levy County, *T. G. Harbison*, June 12, 1915, September 12, 1916, April 25, June 15 and September 25, 1917; Tallahassee, Leon County, *T. G. Harbison*, April 14, 1916; Crawfordville, Wakulla County, *R. M. Harper*, June 19, 1914 (no. 211); Marianna, Jackson County, *T. G. Harbison*, September 19, 1916 (no. 8), April 20 and May 26, 1917.

What is perhaps best considered a variety of this species may be described as—

TILIA GEORGIANA var. **crinita,** n. var.—*Tilia pubescens* Sargent, Silva N. Am. 155, *t. 26* (in so far as relates to South Carolina, not Aiton); Man. 675. *fig. 55.* 1905.—Differing from the type in the longer and more matted, usually rusty brown hairs of the pubescence, usually less closely attached to the under surface of the leaves and often very conspicuous on the young branchlets.

SOUTH CAROLINA.—Sandy woods, Bluffton, Beaufort County, *J. H. Mellichamp*, May 28, 1887; near Charleston, *T. G. Harbison*, September 6, 1915 (no. 13).

GEORGIA.—Colonel's Island, near Dunham, Liberty County, Miss *Julia King*, July 1915, *T. G. Harbison*, September 8, 1916 (nos. 1, 2).

This linden has a general resemblance to *T. Houghii* Rose, which differs in its rather looser pubescence and large and conspicuous tufts of hairs in the axils of the veins. Moreover, it hardly seems possible that a tree known only at a few stations on the coast of South Carolina and Georgia should also grow south of the City of Mexico, and so far as is now known nowhere else.

ARNOLD ARBORETUM
JAMAICA PLAIN, MASS.